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ABSTRACT

The first in a series of booklets on using outdoor education methodologies to enhance the academic curriculum, this guide is written to help teachers of grades K-8 develop activities to enrich science instruction. The introductory sections define outdoor education and provide a rationale for outdoor science teaching stressing the opportunities it provides for creativity, inquiry, and problem solving. The bulk of the guide consists of detailed plans for outdoor sites. Each activity is adaptable for use in several grades and follows a basic lesson plan format stating purpose, concepts, objectives for learners, materials, and procedures. The first set of three activities illustrates ways to introduce students to the school grounds as an outdoor laboratory. Topics are soil, leaves, and litter. The remaining six activities cover concepts of observation, classification, logical thinking and inference, interdependence, and community. Activity titles include: "Observing: The Basis of Science," "A School Yard Alphabet Hike," "The Mystery Sack," "Similarities and Differences," "The Web of Life," and "The 113 Unit Homestead." An appendix lists 17 organizations providing information about outdoor education. (JHZ)

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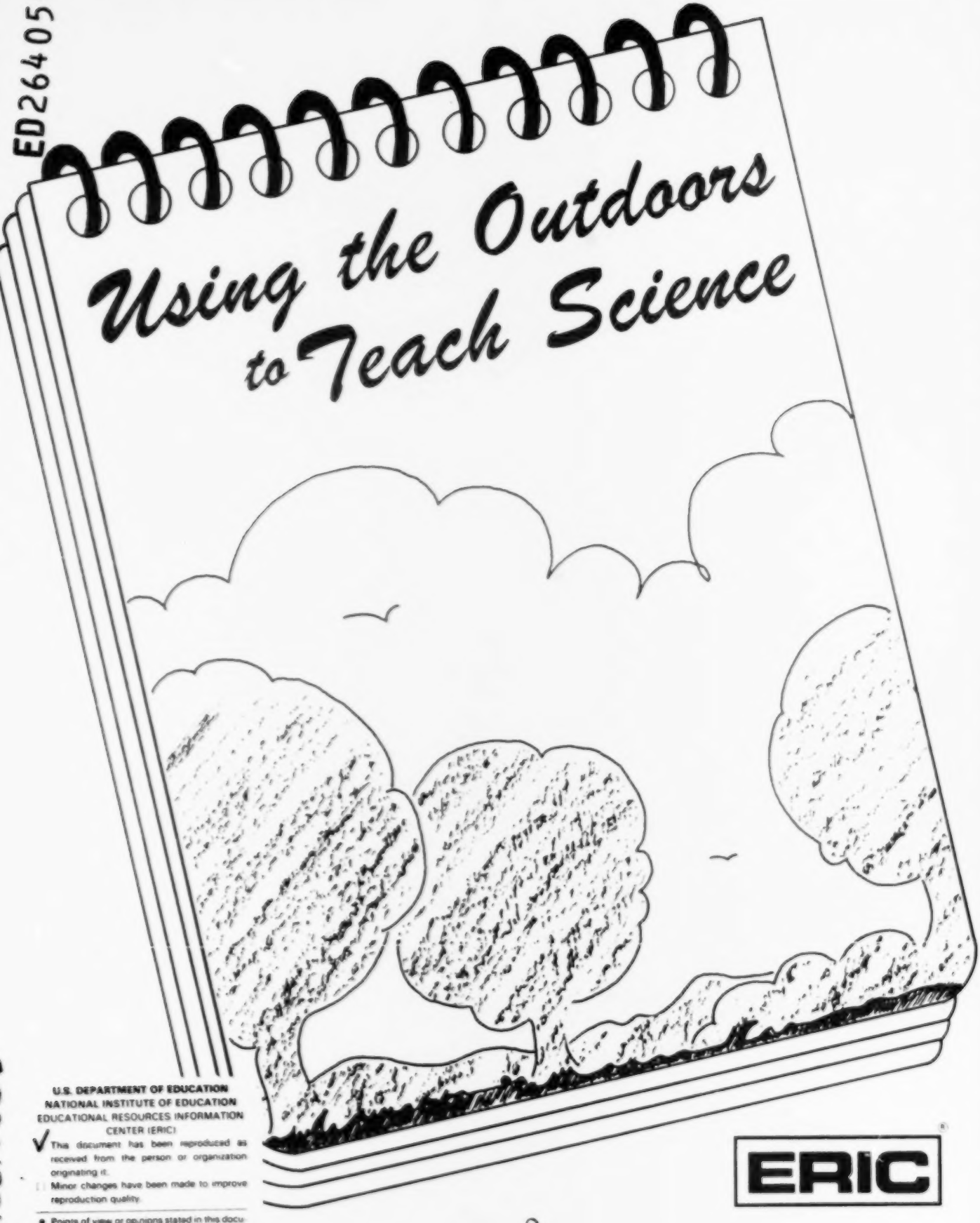

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Using the Outdoors to Teach Science:

A Resource Guide for Elementary and Middle School Teachers

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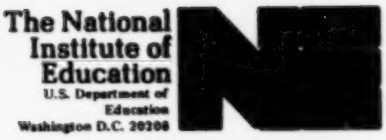

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Preface

This publication initiates an ERIC/CRESS series on utilizing outdoor education methodologies to enhance the academic curriculum. The series is written for teachers in elementary and middle schools and for personnel at outdoor education centers. This booklet will help classroom teachers develop activities that will make the teaching of science an enjoyable and educationally rewarding experience.

Recent events have highlighted the need to intensify and promote science education in American schools. Since use of outdoor methodologies provides opportunities for students to see science in action, these kinds of activities are particulary appropriate as an introduction to the laboratory sciences available in later school years. These learning experiences provide the sound base for study recommended by the National Commission on Excellence in Education for those crucial first eight years of study.

Dr. Milton Payne brings to this work 20 years of experience in the areas of science education, outdoor education, middle school teaching, and individualized instruction. He currently teaches several courses in outdoor education using a multidisciplinary approach and has conducted workshops and seminars in more than 30 school districts including Houston, Fort Worth, Texarkana, and Tyler. Dr. Payne was also one of the Founders of the Texas Outdoor Education Association.

Elaine Roanhorse Benally
Monitor for Outdoor Education
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Note to Teachers

I hope that the activities presented in this guide will help you add a new dimension to your instruction. The activities I have included are those that will help you recognize the number of different science concepts that can be taught more effectively (and as such, will be more interesting to students), in an outdoor environment. Now it's your turn. Look through your textbook, curriculum guides, and other sources. You will find many good science activities. Try your hand at developing outdoor lesson plans for some of these activities. Once you get started, I think you will find the task very interesting. I also believe that once you start using and developing outdoor science activities, you will find the excitement of the children you teach reward enough for the efforts you have extended. Good luck and happy outdoor teaching!

Milton Payne

Introduction

The purpose of this booklet is to help the classroom teacher develop activities which will make the teaching of science an enjoyable and educationally rewarding experience. Many teachers feel unprepared to teach science for a variety of reasons. Some feel they do not know enough science to be comfortable with the subject. Other teachers think they do not have enough laboratory equipment. Still others may have concluded that they do not possess the skills necessary to develop an "activity-centered" science curriculum. If you include yourself in any of these categories, or if you are interested in some new ideas and activities to enrich a science program you have already developed, then read on . . . this booklet was written just for you.

The What, Why, and Where of Outdoor Teaching

It is important that teachers have an educationally sound reason, purpose, or rationale for what they do. As teachers, we have to make choices which will determine the effectiveness of our instruction. Why do we sometimes choose a film to present a subject rather than have students read from a book? Why, when teaching science, do we choose a teacher demonstration rather than an experiment conducted by our students? Since we constantly make such curriculum decisions, they must be based on our best judgment. We should, therefore, be able to explain the reasons for our educational decisions to students, parents, the principal, and other interested persons.

If we plan to take our students outside (which is what this booklet is all about), then we must be able to justify such action: we need a purpose for going outside with our class. But before we can develop a rationale for outdoor teaching, we must first get clearly in mind what is meant by "outdoor education" or "outdoor teaching." When we research this subject by reading professional journals and talking with teachers from schools that have "outdoor education" programs or subjects, it becomes clear that this term has many meanings.

We need some kind of "handle" for the term, or we cannot easily talk about it. And, practically speaking, it will be difficult to convince our principal that we are providing our students with the most effective learning experiences possible unless we can clearly communicate what it is that we are doing.

I propose the following definition for "outdoor education":

> Outdoor education is a teaching method or strategy chosen by a teacher as the most effective means of insuring a student's mastery of selected objectives

> of the curriculum. It involves students in out-of-classroom activities which are direct and relevant and which are difficult or impossible to provide within the classroom.

It now becomes easy to discuss outdoor education. It is a method of instruction. A teacher uses reading groups, learning centers, and classroom bulletin boards because these are effective instructional methods. Outdoor education is one of the many teaching methods available to teachers.

The next point to understand is that a particular method or strategy will not be equally effective for all objectives of the curriculum. It is also true that certain methods of instruction are more effective than others with certain groups of students. Different objectives and different children call for varying instructional approaches. For many objectives of the science curriculum, for much content found in life, earth, and physical science, and for many children, out-of-classroom environments, resources, and activities provide the most effective means of instruction.

Let's examine two examples. The first grade teacher who interrupts the reading period to let her students go out on the school grounds during the first snowfall of the year is wise enough to take advantage of "the teachable moment"--that golden opportunity that is here for a moment and then possibly lost forever. She provides her children with small pieces of black felt or construction paper and magnifying lenses so that they can catch snowflakes and closely examine their unique designs. This is a great teacher! By making such a choice, she matches an instructional objective (having to do with snowflakes) with an appropriate method of instruction. It would be impossible to provide such an experience inside the classroom.

Let's think about another situation with which, I dare say, each of us is familiar. I doubt that any person gets through 12 years of school without being taught "about" the different types of clouds at least six

different times. In the first grade, the teacher shows the children pictures of clouds. In the third grade, the teacher shows pictures with the names of the clouds printed in big block letters under them. In the fourth grade, the teacher shows the children pictures, rolls down a chart at the front of the room, and lets the students read about clouds in their textbooks. By junior high school, teachers still do all of these things but add a filmstrip about clouds. Finally, in high school, each student writes a term paper using no less than five references, including the Encyclopedia Britannica; then, at the end of the unit, a 45-minute film, complete with sound and color, is shown.

Ask 10 adults to name the three basic cloud types, and it's not likely you'll find 4 of them who can correctly name all 3--and besides, who's interested in clouds anyway! In 12 years of school, not one teacher took the students outside the classroom to look at and study the clouds in the sky. This example, and so many similar situations, helps us appreciate the truth found in the classic Chinese proverb:

I hear and I forget
I see and I remember
I do and I understand.

The out-of-doors is a great place for children and youth to do science!

Outdoor Science Teaching—A Key to the Development of Creativity, Inquiry, and Problem Solving

Science is the greatest subject in the school curriculum to teach. Why? Because it is lots of fun to teach and because, of all subjects, it has the best chance of developing children's creativity and thinking skills. A biased statement? Yes, it is. But I would like to think that there is a great deal of truth to it.

Kids love science. Young kids especially love it; they like to bring things to school. They are full to the brim with questions about their environment and everything in it. They are curious, inquisitive, seeking, and searching--until, for many, too much school takes these traits away from them.

We don't want to do that. Educators must encourage--not discourage--original thought, creativity, and inquiry into the unknown and unanswered. Schools, of all places, must be places where thinking and problem solving are nurtured as the priceless skills they are. Science has the power, in the hands of a creative teacher, to accomplish all these things. It can do so inside the classroom, but in many cases it works even better outside the classroom.

Outdoor Science Activities for School Grounds and Other Easy-Access Outdoor Sites

There are two areas, or components, of science as a discipline or subject--content and process. Content has to do with the information of science--the facts, concepts, and theories. Process has to do with the methods of science--the particular means of inquiry used in seeking answers to questions and solutions to problems.

Science in school, at all levels, is too often taught as an accumulation of factual information. Scientific information is an important part of science, but by itself it soon dulls the mind and curiosity and becomes boring to students and teachers alike.

It has been said that blood is the life of the flesh. In science teaching and learning, process is the life of the knowledge and information of the subject. Process is what makes science fun to teach. Process makes science the most interesting subject in the school curriculum. Process is the "finding out": it's the questions, the investigations, and the experiments. It's the "life" of the subject. But, as with the body, you must have flesh and blood to have life. Thus to have a well-balanced science curriculum, we need both science information and the methods of science. Scientists use particular processes or skills to investigate, to discover. Children also can use these skills for the same purposes--and in so doing, they can accumulate knowledge of scientific information and develop their own processes of rational thought.

A great place to accumulate scientific information and develop rational thinking processes is--you guessed it--outside the classroom! I hope the following ideas and activities will begin for you a new and exciting excursion into a new world of teaching. It is the real world, not a world of chalkboard and textbook, but the world just outside your classroom door.

These activities won't cost your school any money. You won't need any fancy equipment. And, if you will start correctly, you will finally get to teach in a situation where there are no discipline problems--well, at least not many.

How do you get started with outdoor teaching? The answer is--you get started very slowly. No matter where you teach or what grade or subject you teach, you will have confusion and discipline problems with outdoor teaching unless you religiously do two things: start slowly and plan well.

Why will you have discipline problems? Because kids are used to going outside for what reason? You're right--to play. That's where they go at recess. The playground is outside. You go to school inside; you play outside.

So what do we have working for us? The first thing is that we must recognize the positive psychology of "going outside." Kids love it! Let's use this for our benefit. We can put this attitude to use in our efforts to improve the educational opportunities of the children we teach.

When you have collected or developed some great outdoor science activities, when you're excited and enthusiastic and can hardly wait to get your kids outside for their first science activity . . . wait. Don't go yet. Those 25 or 30 kids of yours can drain all of your new-found excitement and enthusiasm and trample underfoot your "great activity" as they stampede toward the swings and gym sets. Start slowly!

When you have your outdoor science activity prepared and ready, then it's time to start preparing your students. Explain to them that, in a few days, you are going to do some science activities outside on the school grounds. Name some specific location. Explain in detail

what you are going to do. Discuss with the class the behavior you expect of the group while outside. Do this several times.

Your first activity should be short, very short--no more than 5 minutes. You have been studying rocks, so you take the children to a specific location on the school grounds. Each child picks up a rock and places it in a sack: then you herd them back into the classroom where each child gets to describe his rock.

Keep your first activities short. Each child should understand exactly what he is to do. Introduce the objective of the outdoor activity indoors, do the activity, return to your room, and complete the activity indoors.

You will modify this procedure according to the age and behavior characteristics of your students. However, if you will begin slowly and use simple and very specific tasks for your first few excursions outside the classroom, then you will experience few, if any, problems when you involve your class in longer, more extensive outdoor activities.

The following activities have been chosen as ones which can most easily get you started as a successful "outdoor teacher." These are given to get you started. Your best activities are the ones you will develop yourself. It is easy to develop outdoor science activities. Examine your science curriculum guide or your textbook and ask yourself, "Can this activity--this objective--be taught more effectively indoors or outside?" With a little practice, you will soon be saying "outside" for much of your science curriculum. You will then be developing your own outdoor activities and modifying indoor activities so that they become more effective when performed in the outdoor environment.

The outdoor science activities which follow are not designated by grade level. You will find activities which, with only slight modification, can be used successfully in multiple grades. The activities are written using a basic lesson plan format. Although

objectives and concepts are stated, most of the activities may be revised or their emphases changed to suit individual teacher needs and goals.

Each lesson contains comments to help identify problems to watch for as the lesson is being taught. Also included, when appropriate, are suggestions about planning the lesson and following up in the classroom as well as specific content information.

The first set of activities is called mini-excursions. Their purpose is to illustrate ideas which can be used to initiate students into the outdoor laboratory--the school grounds. They establish behavior guidelines and help the children begin the transition from viewing the school grounds as only a "playground" to understanding that it is also a place where they are going to learn lots of neat things about science. Depending upon the nature of the class, it may be necessary to develop additional mini-excursions before children are engaged in longer, more involved activities. Remember, these first outdoor experiences will set the stage. Success and good behavior with these activities will help insure success with your future activities. Plan well and be as organized as possible.

Topics for other mini-excursions include plants, insects, clouds, weather, textures, shapes, colors, rocks, ants, and many other subjects in the fields of life and earth science.

One note of caution: since you will be taking children outside, it is wise to consider potential areas of danger. If there is an area of the school grounds (or neighborhood park, or other area selected for outdoor learning) which contains potential hazards, you may need to establish an "off limits" area. It is also a good idea to teach a unit on "outdoor safety" before taking classes outside and to have a first aid kit handy in case of ant stings or skinned knees. School grounds, parks, and other such outdoor areas are generally quite safe. However,

accidents can happen anywhere. Prepare yourself and your children for such eventualities.

I. MINI-EXCURSIONS

A. Purpose:

The purpose of these activities is to introduce students to the use of the outdoors as a resource for learning.

B. Concept:

The outdoors provides many resources useful in developing an understanding of science and in acquiring certain basic skills.

C. Objectives:

After completing the following activities, the students will:

1. Appropriately manage their behavior to the extent that they can be responsible learners in an out-of-classroom environment.
2. Describe general rules of behavior appropriate for out-of-classroom learning experiences.
3. Demonstrate a positive attitude toward outdoor learning experiences.
4. Develop the knowledge and skill associated with the particular activity.

D. Materials:

Materials are listed separately for each excursion.

E. Activities and Procedures (details are on the following pages):

Mini-Excursion 1: Soil

Mini-Excursion 2: Leaves

Mini-Excursion 3: Litter

Mini-Excursion 1: Soil

Time:

Outside--5 minutes.

Materials:

1. Magnifying lenses.
2. Sheets of newspaper.
3. Several small garden spades (kitchen spoons will do).
4. One small container for each student.

Objectives:

The student will:

1. Discover the nature and properties of soil.
2. Develop skill in the use of hand magnifiers.
3. Use the senses to collect data.

Procedure:

Introduce the subject of soil in the classroom. What is soil? Is it the same as "dirt"? Why is soil important? How do we use soil? Discuss the correct use of the magnifying lenses.

For this introductory activity, take your students to a predetermined area of the school grounds. Have each child collect a sample of soil. Return to the classroom. Students can pour their soil samples on a sheet of newspaper. They should examine the soil using appropriate senses to discover texture, color, smell, etc. They should use magnifying lenses to discover elements of the soil not readily observable with the unaided eye. Discuss the various discoveries the children have made. Return the soil to the area from which it was removed.

Mini-Excursion 2: Leaves

Time:

Outside--5-10 minutes.

Materials:

1. Sacks for collecting leaves.
2. Butcher paper.

Objectives:

The student will:

1. Use comparators: length, area, shape, height, size, texture, and color.
2. Observe similarities and differences.
3. Group leaves by comparing similarities and differences.

Procedure:

You may wish to use this activity as an introduction to the process of classifying. In the classroom, discuss how objects have properties in common. For example, how are a tree and a rosebush (or other plants of your choice) alike? How are they different? In what ways are our shoes alike/different? Discuss properties and characteristics of objects--color, size, use, shape, etc.

Take the class to an area of the school grounds where there are leaves on the ground. Discourage removing leaves from living trees or shrubs. Have each student collect several leaves that he especially likes. Return to the classroom. Group the children in teams of two or three. The students should identify how the leaves are alike and how they are different. Students may group leaves into sets determined by the properties they have identified. You may want the children to make a simple classification key on a large piece of butcher paper. Children can then share the ways they grouped the leaves. They might see if different leaves from other groups would fit the grouping they have developed.

Mini-Excursion 3: Litter

Time:

Outside -- 5-10 minutes.

Materials:

1. Paper sacks.
2. Butcher paper or poster board.
3. Felt-tip pens.

Objectives:

The student will:

1. Communicate data in an appropriate form.
2. Identify different kinds of litter.
3. Discuss problems which are caused by litter.
4. Develop solutions for problems caused by litter.

Procedure:

Litter exists all around us. It is evident on any school ground. Discuss the types of litter which are likely to be found on the school grounds. Ask the students how their lives may be affected by litter.

Give each student a paper sack. Walk around the school grounds. Each student is to collect different kinds of litter. Return to the room. Group the children in teams of four. Provide each group with a sheet of butcher paper or poster board. Have students discuss the different types of litter that they have collected. Litter groups might include such things as paper, metal, plastic, cloth, wood, etc. Older students might include groups such as biodegradable and nonbiodegradable. Once students have developed groups for the litter they have collected, have each team combine each team member's litter collection. They can then count the items collected within each of their groupings. Instruct the class in communicating the data they have organized. One good

way is through the use of a graph. A bar graph would be appropriate for this kind of data. Teams can then develop graphs on butcher paper or poster board. You might want to make a graph on the chalkboard which would be a composite of the data from each team.

Discuss such issues as types of litter found most often/least often and the effects of litter. This provides an opportunity to introduce the concept that litter is a form of pollution. Have the students suggest ways to reduce the amount and effects of litter on the school grounds as well as in other areas such as parks, cities, and homes.

Note: The previous three activities illustrate the types of introductory activities you should use with your students. You may need to develop several more short "excursions" before beginning the more involved activities which follow.

II. OBSERVING: THE BASIS OF SCIENCE

A. Purpose:

This activity is designed to help children become aware of the fact that few of us are careful observers and that the skill of careful and accurate observation is the basis of scientific problem solving.

B. Concepts:

1. The skill of observation is necessary in scientific investigation.
2. Few people observe as well as they should.
3. The skill of observation can be improved.

C. Objectives:

After completing the following activities, the student will:

1. Demonstrate an improved awareness of the importance of accurate observation.
2. Explain several reasons why most individuals fail to observe objects and events as carefully as they should.

D. Materials:

Two large paper bags.

E. Activities and Procedure:

Begin this activity with a general discussion of problem solving, scientific method, the skills of a scientist, or something similar. Ask the children what they think it takes to be a good scientist. List on the chalkboard the ideas that the students identify as answers to this question.

After this discussion, explain to the students that you are going outside to do an activity. Before you leave the room, review the guidelines for behavior.

Select an outdoor area where the students will be able to find a small rock without too much trouble. They will need the rock for the second part of the activity.

Explain to the students that they are to choose a partner. This is best done in teams of two; however, a team of three students is acceptable in the event of an uneven number. Explain that they are to either stand or sit, as they wish, and talk to one another for a few minutes about a subject you have selected. Choose any subject you think will appeal to them. What they did over the weekend, their favorite singer, hobbies--something that will make conversation easy. Explain that they will be signaled when you want them to stop the conversation.

Allow whatever time you think is appropriate. Then stop the children and get their attention. Ask them to turn around with their backs to their partners. Explain that they should not, at this point in the activity, look at their partners. Ask if everyone understands.

After asking the children to listen carefully, explain that you are going to give directions for the next part of the activity.

One student in each team is to start this part of the activity by asking his partner questions about himself. Questions should relate to observations the partner could easily have made during the discussion such as: "What color are my eyes?" "Am I wearing glasses?" "What color is my shirt?" "Am I wearing a belt?"

Suggest a few questions; then let the students make up others of their own. Partners should take turns asking a series of questions about each other. Depending upon the age of your students, this activity will last 5-15 minutes. You will be able to judge when you should conclude this part. Circulate among the students. Participate as you see opportunity. Have the students conclude their questions. Ask them to arrange themselves in a

semicircle facing you. Help them develop this habit when it is time for you to discuss something with them. The semicircle is the best arrangement for outdoor discussions as it allows you to see each child and allows them to get as close to you as possible. Your voice does not carry as well in the outdoors as it does in the classroom. Take care that the students are in a position so that they can hear and see.

Ask the children to explain what they learned from the activity. They will be very aware of the fact that they were unable to answer many seemingly obvious questions about their partners. Allow them time to discuss some specific examples. Ask them how this activity is related to the classroom discussion about the importance of accurate observation and the characteristics of scientists. Guide them toward the conclusion that each of us can improve our skills of observation. Explain that observing means more than just using our eyes. Ask the children what other ways we collect information. Discuss each of the other senses briefly.

Tell the students that you want them to look around for a few minutes, in an area you point out, and find a "special" rock. They are not to find just any rock, but rather one that has some special appeal. Each student should collect one rock, no one else should see the rock, and it must be small enough to fit easily in the hand.

Allow about 5 minutes for this task. You must set a time limit or some children will explore for the rest of the day! Arrange the children in a close circle. You stand in the center. Remind the children that they are not to allow anyone to see their rocks. Ask them to hold the rocks in their hands and hold their hands behind their backs.

Select several children and ask each to describe his or her rock. See how many use senses other than sight; however, don't comment about this at this time.

The next step in this activity is a surprise to the students. You want them to mix the rocks so that they will be holding another person's rock. There are a variety of ways to do this. One way is to have the children pass the rocks behind their backs from hand to hand. Another means is to have half of the group place their rocks in a paper bag. The other half places their rocks in a second bag. Then each child, without looking, picks a rock from the bag which does not contain his own. At no time should they see any of the rocks. You will have to remind them of this.

Return to the circle. Select a child to describe the rock he now holds. This will challenge the child to use descriptive observations using only the sense of touch. Encourage the students to be as specific as possible and to use texture words, shape words, comparisons to some standard or arbitrary unit of weight, etc. Do this with several children.

An added dimension to this activity is to have one child describe the rock being held and allow other children to ask questions about the characteristics of the rock. The objective is for students to find their rock through description and through their own "data-gathering" questions.

While this is an excellent activity to help children use and develop skills in acquiring data through the senses, it also helps develop a variety of language skills.

III. A SCHOOL YARD ALPHABET HIKE

A. Purpose:

This activity should follow instruction in using the senses as tools of observation. It provides practice in the use of all the senses to gather data. It helps the student develop an understanding of the many dimensions of the outdoor environment. The activity reinforces the fact that we are highly "selective" in what we perceive around us. As we walk across a school ground, we don't "see" very much of what is around us.

B. Concepts:

1. We are surrounded by an environment rich in a variety of elements.
2. The senses are the tools through which we inform ourselves about our surroundings.
3. Classification keys are used to indicate similarities and differences in objects.

C. Objectives:

After completing the following activities, the student will:

1. Identify and name properties of objects or events using each of the five senses.
2. Name properties of objects which could be used to classify the objects.
3. Construct a one-stage classification scheme.

D. Materials:

1. School yard hike task sheet with the alphabet on it in list form (sample on p. 25).
2. Paper bag for each pair of students.
3. Butcher paper.
4. Pencil for pair of students.

E. Activities and Procedure:

Explain to the students that they are to work in pairs for this activity and that each pair should work independently. Their task is to see if they can fill in each letter of the alphabet with an observation from a short hike around the school grounds. They should use each of the senses. Caution them about the sense of taste. Use it only when it is obviously safe to do so.

Before the students begin the hike, give them several examples of the types of observations they may list. If they find an ant, they list it under "A" and code it with "Si" for "sight." If they hear a bird sing, then they may list it under "B," and code it with "H" for "hearing." If they find a rock, pick it up, and feel its texture, then they may wish to list it as an "R" for "rough feeling rock," coded with a "T" for "touch." A following section provides more detail.

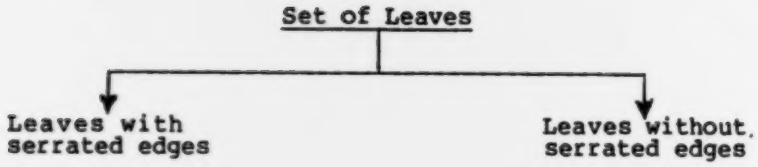
Tell the students to collect some of the most interesting objects observed on the hike. You should establish some guidelines for what they should and should not collect. You may encourage children to return certain objects to the school grounds. Either lead the students on the hike, or take them to a pre-selected location and explain that they are to explore a given area, then reassemble with you in about 15 minutes.

After the students have completed the school grounds hike, you can complete the activity outside or return to the classroom. Discuss the observations they have made in both general and specific terms. Ask students to describe some of the observations from their list. Ask whether they were able to use all of the senses, which sense was used most, and what were some "sound" observations and "smell" observations. Ask what they found for some of the letters. Discuss how much there is to observe on the school grounds. Ask how the hike might have been different in a city park, near a stream, and in other such areas. Explain that we

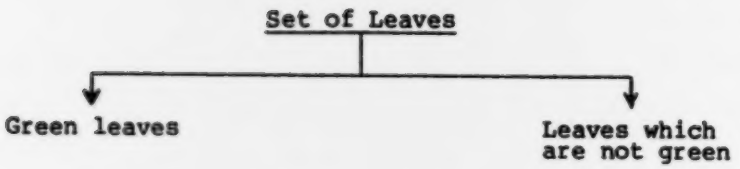
become more aware of the details of our environment if we practice the use of our senses.

Students can now be asked to think about ways to group or classify the observations they have made. Explain that classification is looking for similarities and differences. Ask the children to tell ways some of their observations are alike and ways they are different. Examples might include: some are alike because they were observed using the same sense; some are man-made, others occur naturally; some are brightly colored, others dull; some are litter, others non-litter; some are made of metal, others of wood. Continue this discussion until the children realize how many different ways there are to group different objects.

Tell students that they will now use the objects they have collected to make a simple one-stage classification key. A one-stage classification is based upon the presence of one property in a set of objects. For example, if the children collect several different leaves, there will exist a variety of similarities and differences within the set of leaves. A one-stage classification is based upon the similarities found among a certain number of leaves and the absence of this characteristic among the remaining leaves in the set. Illustrations of one-stage classifications of the leaves follow:


Set of Leaves
Leaves with serrated edges
Leaves without serrated edges

-- or --


Set of Leaves
Green leaves
Leaves which are not green

A SCHOOL YARD ALPHABET HIKE TASK SHEET

Directions: Walk around the school grounds. Use your senses to make observations about things in the environment--the school building, trees, things on the ground, clouds, smells, sounds, etc. Try to list an observation for each letter of the alphabet. Use all of your senses. Code each observation with the sense you used when making the observation. (Use the sense of taste only if you know the object is safe to taste. Check with your teacher if you have any doubt.) Use the following code for the senses:

Sight=Si Smell=Sm Taste=Ta Touch=T Hearing=H

Letter	Name of Object or Observation	Sense Code
A	Ant	Si
S	Sticky touch - tree sap	T
V	Voices	H

Complete as many of the following as you can:

A

B

C

D

E

F

G

H

I

The previous numbered page in the original document was blank

J

K

L

M

N

O

P

Q

R

S

T

U

V

W

X

Y

Z

IV. THE MYSTERY SACK

A. Purpose:

One of the most important skills of problem solving and logical thought is inferring. False conclusions are usually the result of incorrect inferences. There is a close relationship between observing and inferring. Inferences are based upon observations. They are also influenced heavily by past experiences. For example, if it is a cloudy day and you hear a loud noise, you are likely to infer that the noise is thunder. The inference is based upon an observation--the cloudy sky. It is also based upon past experience--you recall thunder you have heard in the past and associate it with rain and a cloudy sky. However, in this case, let's assume that you did not see the jet plane which, in fact, broke the sound barrier and caused the noise. Your observation was a cloudy sky which you saw and a loud noise which you heard. Along with past experience, you put these together and made a logical but incorrect inference.

One of the most important goals of science teaching is to help the child develop an understanding of the relationship which exists among observing, past experience, and inferring.

B. Concepts:

1. Logical thinking is closely associated with the skills of observing and inferring.
2. Past experience is often misleading and can tend to cause us to ignore observations.

C. Objectives:

After completing the following activities, the student will:

1. Name properties of an object using senses other than sight.
2. Distinguish among observations, past experience, and inferences.
3. Construct inferences from a set of observations.

D. Materials:

1. Small paper bags (one per student plus five additional bags).
2. Paper and pencil for each student.

E. Activities and Procedure:

This lesson begins with a teacher-directed activity to be conducted indoors or out, as you choose. Prepare five small paper bags (approximately 10 inches deep and 4 inches wide) by placing one unusual object in each bag. Select such objects as a clothes pin, a water faucet knob, an unusually shaped bone, or a fresh, raw okra pod. Try to find an object for each bag which, in the absence of a sight observation, would be somewhat difficult to identify accurately by name.

Divide the class in five groups. Before giving a sack to each group, explain that the sack is to be passed around the group. Encourage each student to use all senses except sight when the bag is passed to him or her. (The teacher should use judgment in allowing the use of the sense of taste.) Using the other senses, the students will derive some description of the object.

Explain that after all members of the group have had an opportunity to examine the object in the sack, each will state one observation. Rotate from person to person within the group until all observations have been stated.

You will need to emphasize that the students should not try to name the object. Also remind them that they should state only one observation at a time; then it is the next person's turn to name an observation. Observations would include such things as textures, weight, odor (if any), size, shape, sound (when rattled or thumped), etc.

After all observations have been stated, each student in the group is to write the name of the object and share it with the others. When stating what they think the object is, students should explain--based on observations--why they think the object is what they have named.

Upon completion of this part of the activity, you may ask each group to share its findings with the other groups in a class discussion.

If you do not already have your class outside, then take them there now. Give each student a small paper bag. Explain that each person is to search the school grounds for a "mystery" object to be placed in the sack. (Possibly, depending upon circumstances, you may wish to state some guidelines for what should not be placed in the sack as a "mystery object"!) When each student has a mystery object, have the students get in the groups previously organized. Conduct the activity as you did before but have students use their own "mystery sacks."

After the students have completed the activity, explain that an inference is a conclusion or an explanation in which observations and past experiences are the basis of what is concluded. Ask the children to suggest what leads to our being able to make logical and accurate inferences.

Two things determine the accuracy of inferences: (1) the extent and quality of our past experience as it relates to the particular object or situation involved and (2) the extent to which we gather a variety of observations using as many senses as possible.

V. SIMILARITIES AND DIFFERENCES

Note: This activity will extend for several class periods. Divide it according to your time. It should be used at upper-elementary or middle-school levels.

A. Purpose:

People must often deal with similarities and differences in the objects, events, and situations they encounter. In order to be able to deal effectively with objects, events, etc., scientists bring order to these through the use of classification schemes.

All of us use classification schemes in one way or another. Automobiles are classified according to their similarities: those that run on diesel, those that are compact, or those that have eight cylinders. We also identify differences such as color, vinyl roof or not, four-wheel or two-wheel drive, and so forth.

A classification system is used in grocery stores with like items placed in the same area. Scientists classify chemical elements, insects, rocks, minerals, fish, and hundreds of other such categories.

Most students will sooner or later use a classification key. This activity will help them understand not only how to use a classification system, but how to make one. It will also help children understand that methods of non-verbal communication (a classification key, for example) are used in many circumstances. They will also learn that clear, concise, unambiguous communication is necessary if others are expected to understand the intent of our message.

B. Concepts:

1. Classification systems are used to help order and organize information.

2. Scientists use classification keys to identify objects or events.

C. Objectives:

After completing the following activities, individual students will:

1. Construct a multi-stage classification of a set of objects collected from an outdoor environment.

2. Use a classification key they have developed to classify a set of objects not used in the development of their keys.

3. Describe the properties of an object in such a way that it can be easily identified by another person.

D. Materials:

1. Paper bags.

2. Butcher paper.

3. Pencils.

E. Activities and Procedure:

This activity is a companion activity to "A School Yard Alphabet Hike." It extends the concept of classification. If it has been some time since students completed the Alphabet Hike, it would be a good idea to review them on how they had constructed the one-stage classification of leaves.

Take the students to a pre-selected area of the school grounds. Choose an area of diversity if possible--some trees, grass, rocks, etc. If you have an "asphalt" school ground, there will still be plenty of "objects" for this activity. You can even have the students use playground equipment for their classification key.

Sit in the chosen area and ask the students to describe the types of objects in the area. Discuss similarities and differences of the objects named.

Explain that most things are not neatly categorized in the environment; that is, they are not grouped in sets, they are mixed up with one another. We don't find all of the insects in one corner of the school grounds, all the twigs neatly arranged in a stack under a tree, or different types of soils here and there. Explain that scientists make classification systems to help order and explain the relationships in the physical world.

If you have a classification key, you might share it at this time. Most bookstores carry keys for a variety of things--classifications of birds, minerals, fish, plants, and such.

Tell the children that they are going to develop a key. Explain that the key they develop is to be a key that not only they can use, but that anyone else in the class can also use.

Group the class in teams, three children per team if possible. Explain that they are going to explore the school grounds looking for ideas for a classification system. They can decide to make a key for a specific object such as "rocks," or they may choose a general category such as "man-made things" or "living things."

Once they have decided on their "object" or "category" for classification, they should return to you for approval. About the only thing that should not be approved would be things that might be difficult or impossible to work with--for example, clouds.

Give each group a sack. If their object is collectable, ask them to select eight different samples of the objects. If it is not possible to find eight, six will do.

If their objects for classification are not collectable--playground equipment, trees, buildings, etc.--then they should make

drawings, write short descriptions, or even place markers upon the items chosen to represent their collection of objects. Remind the students that once they have developed their key, other students are going to try to use it. The original eight objects must be either collected or identified in some way so as to be accessible to others.

Once you have explained what each team is to do and have reassembled the children, explain the task in the following way, demonstrating the steps, one at a time, using a chart you have made on a large poster board or sheet of butcher paper:

1. Ask the students to take a sheet of butcher paper about 3 feet in length.

2. At the top center of the sheet, draw a circle about 4 inches in diameter.

3. Give a name to their collection ("junk," "outdoor stuff," "rocks"), and write this name in the circle.

4. From the circle, draw two "legs." Draw them about 4 inches long. One should be drawn from about the "five o'clock" position and the other from "seven o'clock." Draw a circle like the first one at the end of each line.

5. Choose a property which is true of one-half of the group (four of the objects since they have collected eight). Possibilities include approximate size or weight (sense of touch), color (sight), special odor (smell), etc.

6. In the circle on the left, write the property chosen to divide the groups in half. Blue, rough texture, man-made, etc. Designate the circle on the right as "non" or "not" the property. The two groups are now "mutually exclusive." That is, an object from our original

collection of eight cannot be placed in both groups. An object is "included" in one group because it has a particular property; objects not having this property are "excluded" from the group. The children would have a classification key which looks like this (Figure 1):

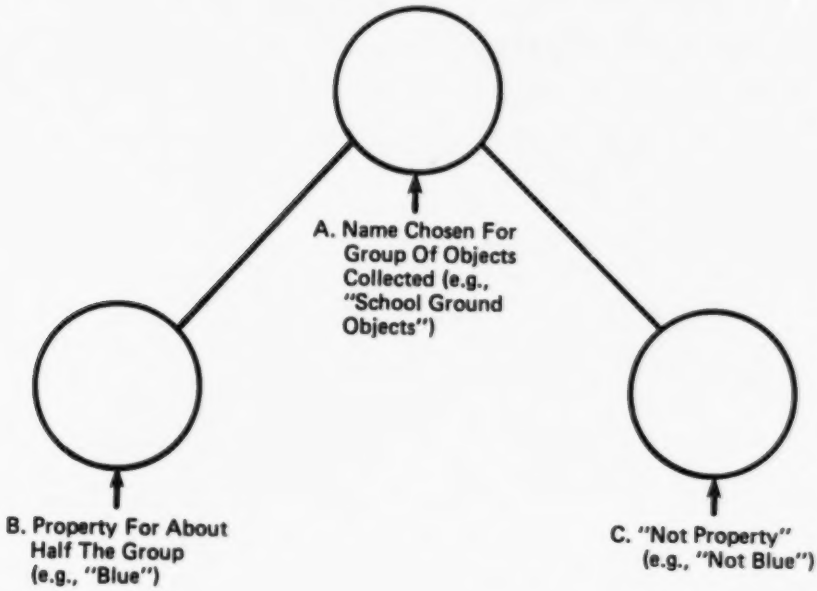

A. Name Chosen For Group Of Objects Collected (e.g., "School Ground Objects")
B. Property For About Half The Group (e.g., "Blue")
C. "Not Property" (e.g., "Not Blue")

Figure 1

7. The next step in the system is to subdivide groups B and C as was done with the original group A. Divide the objects included in group B by choosing a property that is true of about half the group. Draw two "legs" from circle B just as was done with circle A. Do the same with the objects included in group C. The key now looks like this (Figure 2):

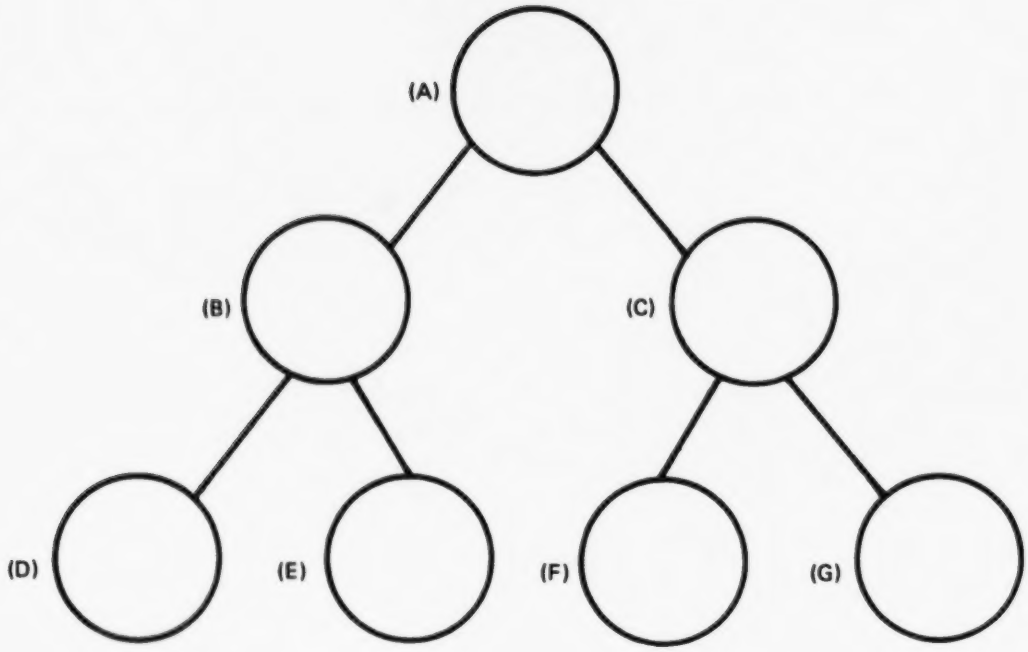


Figure 2

8. A final subdivision is needed to conclude the key. Since each team started with eight objects in the set, the goal is to get each object "keyed" or classified according to its unique properties. Because there were no duplications of objects in the original set, there will be eight final categories in the key--eight circles at the bottom of the chart.

   To finish the key, follow the same steps used in the previous divisions of objects: Divide each group (D, E, F, G) in half using a property characteristic for half the group and a "non" or "not" statement for the other half. This results in the eight objects "keyed out" at the bottom of the chart--H through O.

Figure 3 is an example of a completed classification key if the original eight objects were (1) a bottle cap, (2) a leaf, (3) a rock, (4) a cigarette butt, (5) a gum wrapper, (6) a blade of grass, (7) a yellow pencil, and (8) a dead insect.

Note: Students will not label their keys with the letters A - O nor will they include numbers identifying the objects. This has been done to help you "read" the key in the absence of real objects.

There are many other groupings we could have used with these original eight objects. Also, it is not always easy or possible to divide each group exactly in half. Try to find a property which divides a group in half; if this appears impossible, then group them as you see fit.

When a team completes the key, they should signal you that they are ready for the next step. When two teams are completed, they should trade the objects and the key for the objects. They should then determine if the other team's key "works." They should use the original eight objects and "key" each object. If they have trouble, they should point out the place of difficulty to the team which developed the key.

You may want each team to let you check their key before they begin the last part of this activity. Use your judgment--if it appears that the students have done a thorough job of checking one another, then it's not likely you need to re-check.

Each team should now explore the school grounds and locate other objects which fit the original designation for their classification system. If a team has developed a key for rocks, then the team should locate a "new" rock, one not in the original set used in developing the key, and use their key to classify the

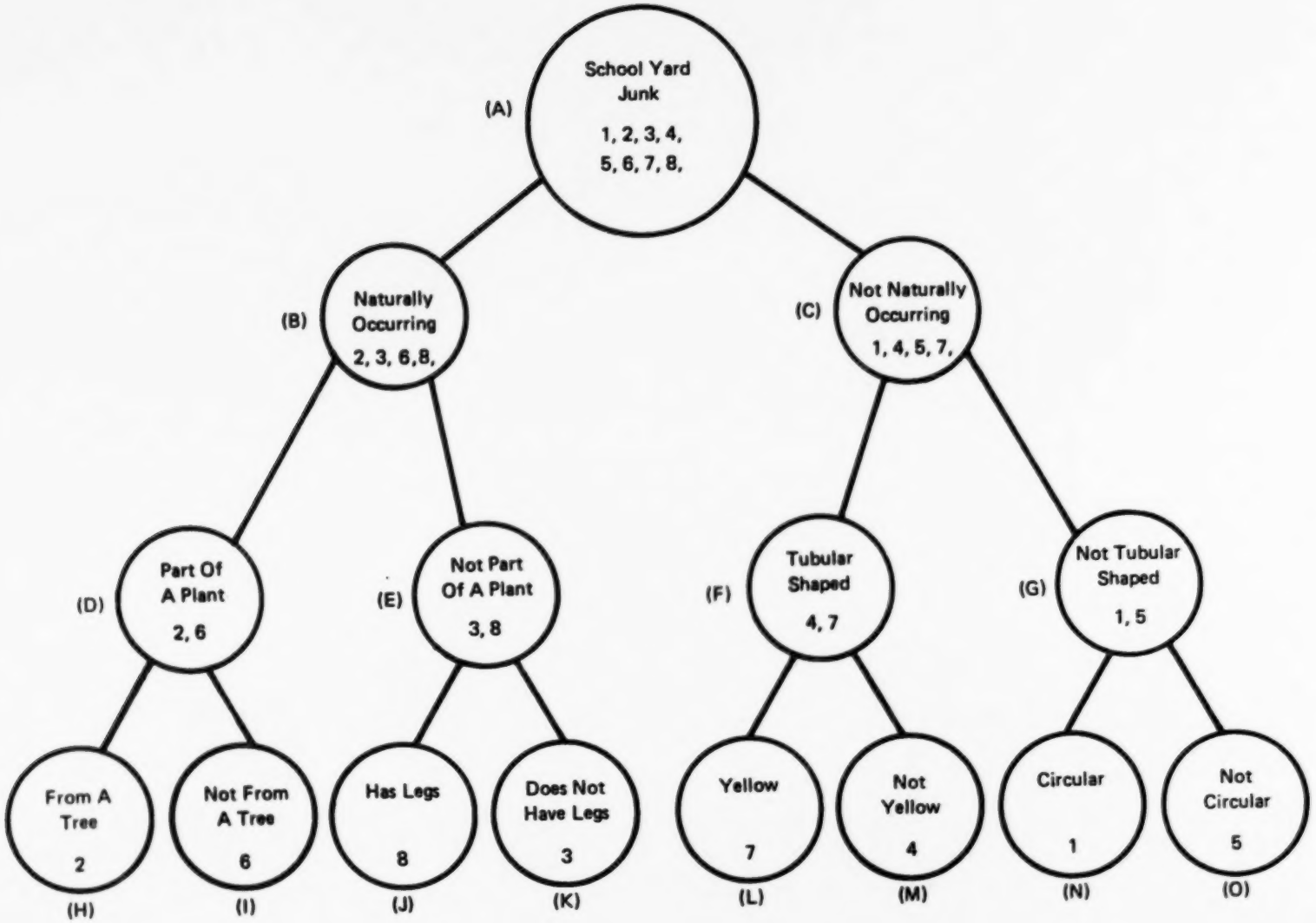

(A)
School Yard Junk
1, 2, 3, 4, 5, 6, 7, 8,
(B)
Naturally Occurring
2, 3, 6, 8,
(C)
Not Naturally Occurring
1, 4, 5, 7,
(D)
Part Of A Plant
2, 6
(E)
Not Part Of A Plant
3, 8
(F)
Tubular Shaped
4, 7
(G)
Not Tubular Shaped
1, 5
From A Tree
2
(H)
Not From A Tree
6
(I)
Has Legs
8
(J)
Does Not Have Legs
3
(K)
Yellow
7
(L)
Not Yellow
4
(M)
Circular
1
(N)
Not Circular
5
(O)

Figure 3

new rock. They will want to continue this activity for some time. Allow them enough time to classify a dozen or so new objects.

As a follow-up to this activity, the students can give an arbitrary name to each of the final "circles" in their key. Thus, when a new rock is keyed, it now has a new name-- a "Bloomper" or a "Shmurf."

Some students may want to extend this activity by designing their own key using other objects. This makes an excellent independent project. For example, if a student collects 20 different insects, he can, with patience, good observation technique, and time, develop his own insect key. The key, properly constructed, following the steps of this activity, will be functional with any other insect collected.

VI. THE WEB OF LIFE

A. Purpose:

This activity helps children understand one of the basic concepts of science--interdependence. There are some excellent discussions to be found in many books about food webs, food chains, and other examples of interdependence. However, there are few concrete activities available to help students become directly involved in learning about the relationships which exist among the elements of our environment.

B. Concepts:

1. There exists an interdependence of organisms and other elements within the environment.
2. Like all other organisms, man is dependent upon the environment and its various interrelationships.

C. Objectives:

1. Explain how organisms in the environment are interrelated.
2. Describe a food web.
3. Infer what will happen if elements in a food web are eliminated.
4. Describe a simple food chain.

D. Materials:

1. Several skeins of yarn.
2. Scissors.
3. Small strips of paper with names of parts of the environment written on them.
4. Paper bag.
5. Five large tags with attached 18-inch lengths of string.

E. Activities and Procedure:

Introduce the term "environment." Ask the children what the word means. Discuss the "environment" of the classroom. Ask the children to identify items in the classroom which are necessary for conducting normal classroom activities. List the items on the board--teacher, students, desks, paper, pencil, and such things should be written. Ask the students if they can think of ways the items on the board are related to each other. An answer might be that the scissors are related to paper, students to chalk, etc. Go to the board and ask them to watch what you are about to do. When you have their attention, erase the word "pencil." Ask the students to explain how removal of pencil from the classroom environment would affect the activities of the classroom. Develop the idea of interdependence--the pencil is not an isolated element in the classroom. It is an essential element tied to many functions and many other parts of the classroom.

Take the class to an open area of the school grounds and ask them to name components of the school ground environment which they can see. Select five students and ask them to line up and face the group. Hang a labeled tag around each student's neck.

A 5" x 7" card with a string loop makes a good tag; it should have already been labeled with one of the following: soil, plant, insect, bird, and fox. Do not place the tags in a pre-selected order. From left to right, you might place the cards randomly: (1) insect, (2) fox, (3) soil, (4) plant, (5) bird. Ask the students if the parts of the environment represented by the five cards are related in any way. Encourage expression of many ideas. Ask the children to think of a logical way you could arrange the five students so that a relationship could easily be seen. Ask them to explain why they suggest their particular arrangement.

Usually the children suggest (1) soil, (2) plant, (3) insect, (4) bird, (5) fox. Explain that this is an example of a food chain. Have the children identify elements of other food chains which can be seen on the school grounds.

You will need to have cut out a small slip of paper for each child in class beforehand. On each slip, write the name of some element in the environment. Place the slips in a large paper bag. What you include will depend upon what you wish to teach and the age of your children. You may wish to begin with half the class and have the others watch. Or you may conduct the activity with two or three groups simultaneously.

Explain that each child is to reach into the sack and pick out one slip of paper. He should read the slip which identifies what he now represents--bird, seed, flower, cloud, tree, twig, rock, dog, pond, fish--just as the first five students represented environmental objects.

Select one student at random and place him a short distance from the group. Give him the end of a length of yarn. Ask the student to call out his name--"fish" for example. Anyone else from the remainder of the group may call out "May I" meaning "May I join the fish because I am related." He must then justify why he thinks he is related. For example, the "pond" says "May I," gives the reason, and then joins the "fish." If you have a "raccoon," he may also say "May I," give his reason (he eats fish), and join the fish. Accept any logical reasons.

Have students stand about 6 feet apart as they join the "environment." Connect the yarn from student to student depending on how they are related. Select a student who has joined the "environment" and ask if anyone is related to him. Continue the activity in this manner until all students are in the "environment." As students join the group, you will need to

continue to link them with yarn. Soon you will have a "web" of yarn.

Explain to the children that they have created a "food web." Ask them to explain the difference between a food chain and a food web. Develop the idea that a food web, or web of life, shows the complexity of relationships existing among organisms and that, in one way or another, each organism affects every other organism. What happens to one organism may ultimately affect all other parts of the web.

As the final part of this activity, explain that you are going to cut the yarn between two parts of the food web. The two affected components of the web are to drop the yarn that they hold and fall to their knees. As soon as these two components of the web are "eliminated," anyone holding a string connecting themselves to the eliminated parts must then drop the yarn which they are holding and drop to their knees. Like dominoes in a row, each will quickly be eliminated.

Explain that the same thing can happen in the natural environment, but that it may take years to observe. Ask the students if they can think of illustrations of animals which have been eliminated--become extinct--or may be in danger of becoming so.

Discuss man's role in the environment. Ask the children what would have happened to man if he had been part of the web. Develop the idea that it is up to man to protect the environment and to conserve the resources of planet earth.

VII. The 113 Unit Homestead

A. Purpose:

This is a fantasy activity in which the children discover the meaning in and importance of a community. A community is a group of elements--plants, animals, soil, streams, etc.--which are present in a particular area. Together they are responsible for the characteristics of the area and what it can and cannot do.

B. Concepts:

1. There is a relationship between an organism and its environment.
2. Even in a small area, there will be a great variation of organisms and other elements of the environment.
3. Man is part of a community.
4. Man is both affected by and has an effect upon a community.

C. Objectives:

1. Describe a community as a group of plants, animals, and other components of a given environment which have an effect upon each other.
2. Explain how man can influence the environment and change the nature of a community.
3. Identify the number and kind of plants, animals, and other components of a small study plot.

D. Materials:

1. A 12-inch paper plate for each group of three students.
2. Magnifying lenses, if available.
3. Paper and pencils for recording observations.
4. Spoon or small spade for digging.
5. Small bag, box, or cup for collecting.
6. Popsicle or craft sticks.
7. String or yarn.

E. Activities and Procedure:

Tell the children that the class has just landed upon a distant planet. The planet has an atmosphere similar to that of earth. The proportions of the planet are quite different, however, from those on earth. The magnitude of everything on plant "Hugeo" is such that everything appears to be hundreds of times larger than what we are used to on earth. Thus, we are the size of ants in comparison to the plants and animals of "Hugeo."

As the "pioneers" of the planet, we will have the right to settle a large area of the planet. To settle the planet, we are grouped in families of three or four.

Our task is to locate our claim and do a survey of what is contained in the area given to us. We are to describe the type of soil present as well as the composition of the soil, rocks, plant, and animal life. Is the area desert-like, or is it covered with trees? In our report we should also describe the probable needs we will have before we can inhabit our 113-unit tract of land. How will we need to modify the area in order that it can more easily support us?

Tell the students that they are about to leave the spaceship (classroom) and go out onto the surface of "Hugeo" (the school grounds). In a "family" of three, they are to identify their 113-unit homestead by tossing a paper plate through the air. Wherever it falls, the area underneath the plate is their new "home." Outline the edge of the plate with 10 popsicle or craft sticks. This is "fence." Use string or yarn for wire if you wish to complete the "fence."

Each family needs a recorder to make notes. First the family describes the general nature of the homestead using the magnifying lenses. Is it barren, rocky, full of trees, diversified, or on a slope?

The family should then collect some of the soil and examine it carefully. They should describe the soil: Does it appear to be fertile? Is it sandy? Closely packed? Rocky? They should dig down into the soil several inches. Does the soil change? How? What kind of plants and animals are present? Look closely. Do they appear dangerous? Are they possible food sources? Describe them. How many different kinds are on that particular homestead?

What other things are found on the land? What will the family need to do to make the land fit to live on? Will it farm the land or raise cattle? Where will the cabin be located? Why was this location chosen?

Once students have completed "exploring" and recording data, each "family" should now show the other "families" their homestead. The recorder for each group should explain all findings and tell what they hope to do with the land. You should encourage comments, questions, and ideas from the class as they move from homestead to homestead.

Discuss the variety of life found in each area. What was found in the soil? Were there both plant and animal life on each plot? Were the plans to modify the plots feasible? Would man have a negative effect on the environment of each area? A positive effect? What could we do to preserve the planet "Hugeo" in as natural a state as possible and yet make it habitable for man?

Finally, ask the students why the activity is called the "113-Unit Homestead"? (Hint: consider the paper plate and use πr^2.)

Appendix

Sources of Outdoor Education Information

American Association for the Advancement of Science
1515 Massachusetts Ave., NW
Washington, DC 20005

American Camping Association
Bradford Woods
5000 State Road, 67 North
Martinsville, IN 46151-7902

American Forestry Association
1319 Eighteenth St., NW
Washington, DC 20036

Association of Interpretive Naturalists
2240 W. Buno Road
Milford, MI 48042

Bureau of Outdoor Recreation
Department of Interior
Eighteenth and C St., NW
Washington, DC 20240

Council on Outdoor Education
1900 Association Drive
Reston, VA 22091

ERIC/CRESS (covers outdoor education for ERIC)
New Mexico State University
Box 3AP
Las Cruces, NM 88003-0042

ERIC/SMEAC Information Reference Center
College of Education
The Ohio State University
1200 Chambers Road
Columbus, OH 43212

National Audubon Society
1130 Fifth Avenue
New York, NY 11028

National Parks and Conservation Association
1701 Eighteenth St., NW
Washington, DC 20009

National Science Teachers Association
1742 Connecticut Ave., NW
Washington, DC 20009

National Wildlife Federation
1412 Sixteenth St., NW
Washington, DC 22201

Outdoor Biology Instructional Strategies
Lawrence Hall of Science
University of California
Berkeley, CA 93305

Safari Club International Conservation Fund
5151 E. Broadway, Suite 1680
Tucson, AZ 85711

Soil Conservation Service
U.S. Department of Agriculture
Washington, DC 20250

Superintendent of Documents
U.S. Government Printing Office
Washington, DC 20402

Van Matre, S. Acclimatizing. Martinsville, IN: American Camping Association, 1974.

About the Author

Milton Payne is a professor of science and outdoor education at Stephen F. Austin State University, in Nacogdoches, Texas. Dr. Payne taught science in the Waco and Austin Public Schools. He attended Texas A & M and North Texas State University and received his EdD degree from North Texas State in 1967.

Dr. Payne's primary interests since joining the faculty at Stephen F. Austin in 1967 have been in the areas of science education, outdoor education, middle-school teaching, and individualized instruction. He has conducted workshops and seminars in more than 30 school districts including Houston, Fort Worth, Texarkana, and Tyler.

He has presented papers before the Texas Academy of Science, the Texas Middle School Association, the Texas Outdoor Education Association, and other professional organizations. He was among the founders of the Texas Outdoor Education Association. Articles he has written about science and outdoor teaching have appeared in several regional and national publications.